

Brain simulation reveals benefits of emergency cooling treatment

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Fresh insight into how the brain responds to medically induced cooling could inform treatments for head injuries and conditions such as stroke.

The study, carried out in 3-D simulations, could also help babies at risk of birthing complications.

A newly developed [model](#) of [cooling](#)'s impact on the scalp has shown that the process—routinely used to limit head injury—can prompt a beneficial drop in temperature deep in the brain.

The research shows that lowering the brain temperature after head injury or stroke helps relieve pressure inside the [head](#) to avert swelling and further injury, especially in critical cases.

Researchers examined in greater detail than ever before how lowering scalp temperature impacts on blood vessels and tissue throughout the brain.

The model, developed by engineers in collaboration with medical experts at the University of Edinburgh, is the first to take into account simultaneous flow, heat transfer and metabolism between arteries, veins and brain tissue in three dimensions throughout the organ.

The results, obtained as 3-D temperature and blood volume maps, could help develop and test therapeutic cooling techniques and inform sophisticated clinical trials.

Using computer simulations, researchers from found that cooling the heads of newborn babies to 10C would enable their core brain temperature to fall from a normal level of 37C to below 36C—which is recognised as low enough to aid recovery.

This could dramatically help babies at risk of long-term damage from birth complications, without having to cool their entire body, researchers say. When applied to adult brains, the model predicted cooling was able to precipitate a potentially beneficial 0.5C drop, in line with clinical observations.

Researchers who developed the latest model say it could be modified to mimic the effects of stroke in the brain, or the impact of administering drugs.

The study, published in *Scientific Reports*, was supported by the Engineering and Physical Sciences Research Council.

Dr. Prashant Valluri, of the University of Edinburgh's School of Engineering, who led the study, said: "Our sophisticated model should enable speedy progress in developing optimum treatments involving [brain cooling](#), and support the development of studies on brain health."

Professor Ian Marshall, of the University of Edinburgh's College of Medicine, who co-led the research, said: "Getting vital patient information such as core [brain](#) temperature is a challenge and is only currently possible through expensive MRI scans. A robust model which can predict [temperature](#) and blood flow is therefore the need of the hour."

More information: Stephen Blowers et al, How does blood regulate cerebral temperatures during hypothermia?, *Scientific Reports* (2018). [DOI: 10.1038/s41598-018-26063-7](https://doi.org/10.1038/s41598-018-26063-7)

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